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ECONOMIC REALITIES OF RECLAIMING NATURAL RESOURCES IN SOLID WASTE

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Economic realities of reclaiming natural resources in solid waste

The amount of solid waste collected from each person daily has increased from 2.75 pounds in 1920 to 5.3 pounds in 1968 and is projected to be 8 pounds by 1980. Therefore, managing solid wastes in a manner that will maintain the quality of the environment at a reasonable cost has become increasingly difficult. The present disposal techniques–burning, dumping, and landfilling–result in an apparent loss of resources. With reclamation, however, waste materials such as old bottles, cans, and paper may be processed into usable commodities. Congress recognized this when it passed the Resource Recovery Act of 1970, which is designed to promote and encourage recycling of solid wastes through the use of research and development, education, and economic and financial incentives.

Processes for recovering resources from solid waste are subject to economic constraints in that the cost to the user of the reclaimed material must be competitive with that of raw materials.

In this paper, the author examines what is being done to recycle significant items of solid waste and litter–paper, aluminum cans, glass containers, and textiles–and the economic barriers that operate

against success in these efforts. Finally, we shall examine some proposals that might lower these barriers. This discussion is based on dialogue held with various trade associations and firms active in the field of recycling, as well as with a public-spirited group in Berkeley, California, and the Goodwill Industries. It also draws upon a report prepared for the Solid Waste Management Office by the Midwest Research Institute on the economics of the salvage market.[1]

Some Items of Solid Waste

Paper

Paper constitutes the single largest item in solid waste; it accounts for almost 50 percent of both litter and solid waste streams. If most of the paper content could be removed from the solid waste stream and recycled, solid waste collection and disposal costs would be reduced significantly.

The paper industry has long been using scrap paper as a raw material. A certain type of cardboard called combination paperboard, for instance, is produced almost entirely from waste paper. Its uses include packaging, book covers, and backs for pads of paper. Because of competition from paperboard made from virgin pulp, however, the production of combination paperboard has been declining in recent years.

Another end use for waste paper is the manufacture of newsprint from old newspapers. In 1961, the Garden State Paper Co.,* Garfield, New Jersey, developed a process by which old newspapers are pulped, deinked, and processed into newsprint. The finished product compares favorably with virgin newsprint. Garden State has three plants in the United States: Garfield, New Jersey; Alsip, Illinois (outside Chicago); and Los Angeles. It is presently considering establishing a plant somewhere in the Ohio Valley that will draw upon cities such as Louisville, Cincinnati, and St. Louis for its supply of old newspapers.

A Garden State Paper Co. plant must have an ensured daily supply of 300 tons of newspaper for it to

*Mention of commercial products does not imply endorsement of the U.S. Government.

operate at the break-even point. From this 300 tons, the plant produces about 280 tons of newsprint and sells it for about $5 to $7 below the market price for virgin newsprint; it usually sells all it can produce.

The quality of the recycled newsprint compares favorably with that of the virgin product. It is superior in printability and tear-strength. Although its tensile strength is less than that of virgin newsprint, the recycled newsprint has about five times the pull exerted by the presses. Because sharper knives are required to cut the printed newspapers, recycled newsprint is unsatisfactory for small publishers who might not be able to maintain their equipment as well as the larger publishers.

According to the chairman of Garden State, currently about 22 percent of the newsprint used in the United States is collected and reused. If paper drives increased this rate of collection, plant capacity of paper recyclers could not absorb the additional amounts. In fact, if a new source of waste paper provided substantial amounts on a fairly continuous basis, this new source would supplant, not supplement, the others. As an example, the city solid waste workers in Madison, Wisconsin, collect segregated and bundled newspapers separately. The collected newspapers are sold to a paperstock dealer and are then recycled in the Garden State's Chicago plant. This Madison program does not increase the amount of paper recycled, however; it merely substitutes Madison-collected paper for Chicago-collected paper.

The paperstock dealers and brokers play an important role in getting the waste paper from the sources to the users. Usually the dealer sorts and bales the paper and ships it to the user. The broker acts as a middleman and arranges the purchases.

An axiom of the salvage business that "scrap materials are purchased, not sold" is particularly true for the paperstock business. When the supply of paperstock exceeds the demand and the price falls, small dealers may be forced out of business. Recognizing the need to preserve the dealers as sources of this raw material, some users, such as the Garden State Paper Co., put a floor on the price they will pay just to keep the small dealer in business.

Family-owned paperstock firms, as well as firms dealing with other scrap materials, have also been disappearing. The sons of owners go to college and, after earning degrees, are unwilling to take over the family business. When the owners retire, so do the businesses.

Collections of waste newspapers from residential sources can be turned on and off as the supply warrants. If the supply of old newspapers is short, paperstock dealers can work with such civic and charitable groups as Boy Scouts, churches, and PTA's to sponsor fund-raising paper drives. If there is an oversupply, these drives can be discouraged and turned off.

Aluminum Cans

A friend of mine and I were once discussing environmental pollution, and he made the following comment: "I remember as a kid that when I'd walk through the woods and see a rusty can, I would view

it with disgust; now I would rather see a tin can rusting away than an aluminum one that doesn't disintegrate at all."

Such statements, made by people who care about the environment, concern the aluminum industry, which has invested huge sums to produce and promote aluminum cans and to expand the market. Currently, aluminum cans hold a small but expanding percentage of the beverage container market; although sales of all aluminum products have fallen off recently, sales of aluminum cans in 1969 rose about 16 percent. So far, aluminum cans are mostly marketed in areas of large population concentrations, such as the Los Angeles–San Diego and the Boston–New York corridors.

In response to criticism of the environmental insult that could be caused by their product, Reynolds, Alcoa, and Kaiser have initiated programs to collect used aluminum containers. These programs are designed to assist in controlling litter and to recover the aluminum for reuse. The aluminum in the containers is fairly clean and free of alloys and can easily be used as a raw material.

Reynolds Metals Co., the Nation's second and the world's third largest producer of aluminum, has established a reclamation recycling program. Can-collection centers have been set up in areas where there is an abundance of all-aluminum cans--Los Angeles, San Francisco, Tampa, Houston, New York, and Newark. Individuals and organizations are urged to bring in aluminum cans and other clean household aluminum scrap, such as foil. (Reynolds even distributes large plastic bags to aid in collection.) At the center, the aluminum is redeemed at 10 cents per pound; without contaminants this would amount to $200 per ton. Because such items as steel cans, lead and steel pipe, bricks, and wood are found hidden among the sacks and boxes of aluminum cans, the cost of acquiring the aluminum is higher than $200 per ton.

For a sample cost analysis, consider the September 1969 figures the Reynolds collection center in Los Angeles reported to the Midwest Research Institute. During that month, the center processed 22.9 tons of aluminum acquired at $330 per ton. The cost of processing, which included processing, building and equipment depreciation, labor, miscellaneous expenses, and freight, was another $308 per ton. Handling costs at the receiving plant, which included conversion costs, cost of metal lost in conversion, etc., were $170 per ton. The total cost of $808 was $268 more than the $540 per ton for Grade I shot. Reynolds has exceeded the estimated break-even point of 32.5 tons per month for its Los Angeles center. As other aluminum companies attain their break-even point, they should be willing and even eager to retrieve old aluminum products.

Reynolds is not the only aluminum company with a collection program: Alcoa has a similar collection center in San Diego and Kaiser in San Francisco. Furthermore, the Adolph Coors Company, a brewery in Golden, Colorado, is cooperating with the three aluminum companies to collect cans. Coors, which puts a large percentage of its beer in aluminum cans, operates collection centers through more than 200 of its distributors in Colorado, Arizona, Idaho, Kansas, Nevada, New Mexico, Oklahoma, Utah, Wyoming, and parts of Texas and California.

According to the Midwest Research Institute, the redemption centers are collecting somewhat less than 5 percent of all aluminum cans produced. Although this does not seem significant, the industry believes these cans would have ended up as litter. Hopefully, however, as the collection programs expand and are given more publicity, a greater percentage will be removed from the solid waste stream.

Glass Containers

Glass containers, like aluminum cans, are nondegradable and are a specific target of the environmentalists. Of particular concern is the increasing trend to the use of no-deposit, nonreturnable beverage containers. Legislation has been proposed in the Congress and in various State legislatures to ban the sale of beverages in nonreturnable containers. One municipality, Bowie, Maryland, has passed such an ordinance. It was being contested in the courts before its effective date of April 1, 1971.

In response to adverse publicity, the glass industry, acting through the Glass Container Manufacturer's Institute, Inc. (GCMI), has for a number of years been actively attempting to solve litter and solid waste disposal problems involving nonreturnable glass containers. For example, in 1953 it was one of the founders of Keep America Beautiful, Inc., whose purpose is litter control. The GCMI position is that banning nonreturnable containers is not the solution.

According to GCMI data, glass containers represent about 5 percent of municipal solid waste and about 6 percent of roadside litter. Furthermore, of the glass containers in roadside litter, one-way beverage containers account for less than half; the rest are deposit bottles and other types of glass containers.

The beverage market has been geared to the use of convenience containers. Many grocery store chains refuse to bother with returnable beer bottles; some don't even handle returnable soft drink bottles. Given a choice, the consumers also apparently prefer the convenience of nonreturnable bottles and are willing to pay a higher price and forgo deposits. As a result, not only has the use of returnable bottles decreased, but so has the number of their round trips.

According to an interesting survey that Allied Supermarkets, Inc., conducted in its Michigan stores, shoppers preferred returnable to nonreturnable bottles by a margin of 63.5 percent to 36.5 percent.[2] Allied reported, however, that "actual sales show nonreturnables out-selling returnables."

As an alternative to a direct ban of nonreturnable beverage containers, the solution might be to somehow remove them from the solid waste stream and to reuse them or recycle the glass. Currently, to promote support for this solution, more than 100

glass-container manufacturing plants in 25 States are redeeming from the public and recycling used bottles and jars. The used glass containers are redeemed at the plant site for 1 cent a pound ($20 per ton) provided the containers are separated by color and are free of metal contaminants. Collection centers have also been set up in other areas. Owens-Illinois, for example, is running an experimental bottle collection center in a shopping center in Ann Arbor, Michigan. There the company pays only ½ cent a pound because it must transport the glass to its plant in Charlotte, Michigan. In its first 2 weeks of operation, the center collected 260,000 bottles or jars, or 130,000 pounds of glass, for which the company paid $650. The glass industry has also been aided by community groups who collect glass to raise funds as well as to better the environment.

According to the GCMI, the industry is willing to receive the old glass. Traditionally, the glass container industry has used cullet (crushed glass) for about 5 percent of its raw material; most of this was obtained in-house. The use of cullet hastens the melting of the other ingredients--sand, limestone, and soda ash--in the glass furnaces. Industry research, however, indicates that cullet can be used for 30 percent of the raw material, and perhaps for as much as 50 percent. Because the cullet is more adaptable for direct feed into the glass furnaces, the $20 per ton the industry pays for cullet is comparable to the $18 it pays for a ton of raw materials.

Research has also been conducted on other potential uses of cullet. One such use is Glasphalt, a street and highway paving material. In Glasphalt, crushed glass is substituted for crushed limestone aggregate in traditional asphalt. The University of Missouri at Rolla developed and is testing this material as a project partially funded by a Solid Wastes Office research grant. Test sections of road are paved with the material at Rolla and at glass company facilities in Toledo, Ohio, and Winchester, Indiana.

Although Glasphalt would provide a use for waste glass, it could never seriously compete in volume with regular asphalt, for if all the glass containers used in the United States were converted into Glasphalt, there would be only enough to produce a maintenance layer of about 300 miles of four-lane highway each year.

Crushed salvaged container glass might also be used to produce building materials such as bricks and insulation, reflector materials, sewer pipes, costume jewelry, and chicken grit.

Textiles

Although textiles are not a significant percentage of all solid waste, they are included in this discussion because of their history of and potential for recycling.

The old-rag man is a thing of the past. He used to go around with his cart and collect discarded textiles from housewives. These old textiles were primarily used as industrial wiping rags.

But things have changed now. For one thing, the industrial wiping rag market has declined. Industry uses more disposable paper wipers at the expense of cotton rags, and with the increasing use of synthetic and permanent press fabrics, there are fewer suitable absorbent cotten textiles to collect and recycle as wiping rags.

Once, articles of used clothing were shipped abroad where there was a demand for them as wearing apparel. With the increasing affluence in the rest of the world, however, this market has so dwindled that it is practically nonexistent.

Let's examine the ways by which textiles currently are collected and recycled. Of course, the greatest source is the clothing and textile industries that sell their scraps to textile dealers.

Ingenious housewives often recycle textiles right in the home. Wearing apparel that wears out or is outgrown, e.g., diapers, linens, can be converted into cleaning rags, doll clothes, or baby clothes.

The householder might dispose of discarded textiles through social service organizations such as Goodwill Industries, Salvation Army, Volunteers of America, or the Society of St. Vincente de Paul. The textiles are collected from bins placed in shopping center parking lots; through special clothing drives conducted with the cooperation of schools, Boy Scouts, etc.; and through special pickups at the homes. In addition, retail clothing stores might donate their unsalable merchandise to the organizations.

When the textiles are received at the Goodwill plant, they are sorted into salable and nonsalable items. The salable items are given minor repairs, cleaned, pressed, and put on the racks at the retail outlets. (Because the clothes sold at the Goodwill stores are usually a year behind those at regular clothing stores, Goodwill hopes there are no drastic year-to-year changes in fashion!)

Textiles unsalable as wearing apparel may or may not be sorted according to fiber content, but they are bundled and sold to textile dealers. The dealers are primarily concerned with the cotton content of the bundles for use as industrial wiping rags. The other textiles can be used in the manufacture of such items as paper and roofing materials. A Goodwill plant in an industrial area, such as northern Ohio, may produce the wiping rags itself.

Economic Barriers to Recycling

From the above discussion, we can see that there are two basic economic barriers to the successful recycling of solid waste--collection and markets for the reclaimed resources. The conclusions that can be drawn from the examples on paper, aluminum cans, glass containers, and textiles are generally applicable to other consumer items as well. (Industrial and commercial solid wastes, being fairly homogeneous, are more readily adaptable to recycling; recycling nonconsumer items should be the topic of another discussion.)

Mechanical Sorting of Solid Waste

Residential solid waste is usually pretty heterogeneous. With very few exceptions, such wastes are not segregated before collection, and, therefore, separating reclaimable materials from residential solid waste becomes a costly problem.

One promising technique, which is being researched by the Black Clawson Company, Middletown, Ohio, utilizes a hydrapulper to pulp solid wastes, reclaim secondary fibers, and separate inorganic products like metals and glass. Special filtering and screening devices reclaim fibrous materials, which can be used to make paper products; unusable organics, such as plastics and rubber, are rejected. A plant receiving 500 tons of refuse per day will yield 200 tons of usable materials: 100 tons will be paper pulp (dry basis);45 tons, metal; and 55 tons, glass.[1] The other 300 tons will be nonreclaimable organics; miscellaneous materials such as stone, ceramics, and metal fines; ash; dirt; suspended particles; and moisture. A cost analysis reveals that a 500 ton per day plant will cost $13.54 per ton of reclaimed materials to operate, and that $13.75 per ton could be realized from sales of reclaimed materials, for a net gain of $0.21 per ton. Such analysis does not include a credit for disposal costs foregone.

Another promising mechanical sorting technique is the incinerator residue recovery process developed by the Bureau of Mines. According to an unpublished report, "the process, which is comprised simply of a series of shredding, screening, grinding, and magnetic separation procedures, yields metallic iron concentrates, clean nonferrous composites, clean fine glass fractions, and a fine carbonaceous ash tailing."[3]

Theoretically, 82.9 percent, by weight, of the incinerator residue should be salable. According to

Bureau of Mines data for the described process, a plant handling 250 tons of incinerator residue per day will have costs of $7.67 per ton of salable residue. Such costs for handling 1,000 tons per day would be $4.89 per ton. If all the recovered material can be marketed and if credit is taken for landfill space and operating costs saved, this process could very well prove to be economically desirable, particularly for the larger plant.

Segregation at the Source

These approaches are very well and good. But they involve processes that might or might not be economical. The most economically promising process might be the most difficult to establish, but in the long run it might be the most successful. It involves the housewife--the person who can exert the most influence to accomplish primary segregation.

To support the war effort during World War II (and, incidentally, to obtain additional ration stamps), the housewife would regularly flatten tin cans, save them, along with newspapers and grease, and turn them in. Schools and groups such as Boy Scouts regularly held paper drives. Saving and reclaiming salvageable materials became a way of life.

Today we need the same patriotic enthusiasm to protect our environment that we had 25 to 30 years ago to protect our country. Some of this enthusiasm is present and is being capitalized on by public-spirited groups across the country. In some communities, the Boy Scouts will hold periodic paper drives. "Ecology" drives are held to raise funds for a charitable purpose by collecting old bottles and cans. But these drives are quite often onetime affairs.

Some groups have established continuing collection centers. One such group is Ecology Action in Berkeley, California. In April 1970, in response to Earth Day, Ecology Action started a recycling collection center in the parking lot of the Consumer Cooperative of Berkeley. With little or no publicity on its part, it has had phenomenal success. Tonnages received have increased by about 15 percent for every weekend it has been in operation. As a matter of fact, it has become almost too large for the group to handle itself. Ecology Action estimates it serves between 1,500 and 2,000 families and reclaims some 100 tons of waste materials per month.

Ecology Action is run by a few young concerned citizens who have level heads under their long hair. The householders seem to accept and appreciate Ecology Action's insistence that newspapers be tied in bundles and include no magazines; glass containers have all labels removed and be washed, segregated by color, and free of any metal contaminants; and metal cans have labels removed and be washed and flattened.

Before it started its collection center, Ecology Action obtained firm agreements from various firms and

dealers in the Bay area for the sale of the collected materials. It also receives financial and moral support from the business community and the blessings of the Berkeley City Council. But again, the backbone of this operation is the housewife. In Berkeley, at least, she had been willing to segregate and prepare her bottles, cans, and newspapers and to have her husband put them in the back of the car and take them to the center. Surely, similar collection activities can operate elsewhere.

It will be interesting to see if Ecology Action can maintain its success. If it can, it plans to expand its activities by instituting satellite neighborhood collection points throughout the entire community. Ecology Action has an ambitious program; with the continued help of the housewife, it can succeed.

Even when items in solid waste can be economically and successfully mechanically sorted or manually segregated, markets must exist for the reclaimed materials. There's the rub. If industry cannot economically and successfully market products made from reclaimed materials, then no incentive will exist for recycling. This the paper industry, for one, recognizes. Last October the American Paper Institute sponsored a seminar in Washington, D.C., on recycling waste paper.[4] An opportunity was provided for discussion between government officials and the top management of the paper industry. The recurring theme of that seminar was that it would take concerted effort by both industry and government to accomplish greater recycling of waste paper.

Suggestions for Federal Action

Proposals have been made that involve action the Federal government could take to accomplish greater recycling. These are only proposals; before any of them can be accepted or rejected, they must be closely studied and scrutinized, with all possible ramifications investigated. Blind action can do more damage than good.

Because the Federal government is one of the largest purchasers and users of paper and paper products in the country, it has been suggested that regulations could be formulated to require that the paper and building materials it purchases must contain a certain percentage of recycled fiber and that tax and other economic incentives could be provided to encourage recycling.

Other suggestions might merit scrutiny. For instance, freight rates for scrap materials, which are set by the Interstate Commerce Commission, might be more in line with those for raw materials. (In 1966, the average cost per ton to haul ferrous scrap material was $4.12, whereas the cost for iron ore was $1.64.)

Or, controlled reuse of liquor bottles could be permitted. Or, because about 60 percent of the newsprint in this country comes from Canada, the tariffs on imported newsprint could be increased and the use of recycled newsprint encouraged thereby.

Depletion allowances for mined, reusable natural resources might be reduced to further encourage recycling. Taxes or fees on recyclable disposable items could be imposed, which would be refunded if the items were properly redeemed.

Summary and Conclusions

By examining present efforts to recycle paper, aluminum cans, glass containers, and textiles, we have seen that the two economic constraints of successful recycling of solid waste are collecting and marketing the reclaimed resources. Solid wastes can be manually sorted and mechanically separated on an economic basis if a market exists for the reclaimed materials.

Such a market will exist if a demand exists for recycled products. If recycling is successful, the burden on the solid waste disposal system would be decreased. But it will take the full cooperation of everybody-- government, industry, and the housewife. Our environment can expect no less of us.

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